WHAT IS CLAIMED IS:

1. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the step of:

irradiating a machined portion of the wiring board with the pulsed laser beam for a beam irradiation time ranging from 10 to 200 μs and with energy density of 20 J/cm^2 or more.

2. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the step of:

irradiating the same machined portion of the wiring board with the pulsed laser beam with intervals of a beam irradiation pausing time of 15 ms or more and energy density of 20 J/cm^2 or more.

3. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the steps of:

combining into one pulse group laser beams including a plurality of pulses respectively having energy density of 20 J/cm^2 or more and generated at intervals of a predetermined beam irradiation pausing time; and

irradiating the same machined portion of the wiring board with a pulsed laser beam with the plurality of pulse groups respectively including the plurality of pulses at intervals of a pulse group interval irradiation pausing time longer than the predetermined beam irradiation pausing time.

4. A laser beam machining method for a wiring board according to claim 3, wherein the predetermined beam irradiation pausing time is 4 ms or more, the number of pulses in the pulse group being 4 or less, and the pulse group interval beam irradiation pausing time exceeding 20 ms.

5. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the step of:

at a time of scanning a surface of the wiring board while irradiating a machined portion of the wiring board with the pulsed laser beam, scanning by the laser beam such that the machined portion is not continuously irradiated with the laser beam over 4 pulses and at intervals of a beam irradiation pausing time less than 15 ms.

6. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the steps of:

at a time of scanning a surface of the wiring board while irradiating a machined portion of the wiring board with the pulsed laser beam, providing a 1 mm beam diameter on a

surface of the machined portion; and

scanning the surface of the wiring board at a scanning speed ranging from 8 to 6 m/min while irradiating the machined portion with the laser beam for a beam irradiation time ranging from 10 to 200 μs and at intervals of a beam irradiation pausing time of 2.5 ms.

7. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the steps of:

setting the laser beam to have a square spot effective in machining of a machined portion of the wiring board; and

scanning a surface of the wiring board while irradiating the machined portion of the wiring board with the pulsed laser beam.

8. A laser beam machining method for a wiring board according to claim 7, wherein the square spot of the laser beam on the machined portion is set to have a size of 0.9 mm x 0.9 mm, and the surface of the wiring board being scanned with a scanning speed of 6 m/min and a scanning pitch of 200 μm while irradiating the machined portion with the laser beam for a beam irradiation time ranging from 10 to 200 μs and at intervals of a beam irradiation pausing time of 1.25 ms.

9. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board with a metallic layer formed on a base material surface, and the method comprising

the steps of:

previously removing the metallic layer corresponding to a machined portion of the wiring board;

forming a base material removed portion through machining by irradiating a base material of the machined portion with a laser beam through the metallic layer removed portion; and

additionally irradiating the base material removed portion and a periphery of the base material removed portion, or only the periphery of the base material removed portion with a laser beam.

10. A laser beam machining method for a wiring board according to claim 9, wherein the additionally irradiated laser beam has a smaller peak output than a peak output of the first laser beam, and is used to scan at a higher scanning speed than a scanning speed during first laser beam irradiation.

11. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board with a metallic layer formed on a base material surface, and the method comprising the step of:

at a time of previously removing the metallic layer at a portion corresponding to a machined portion of the wiring board, partially removing the metallic layer such that the laser beam can reach only an outer periphery of a base material removed portion to be formed by irradiating a base material of the machined portion with the laser beam.

12. A laser beam machining method for a wiring board according to claim 11, wherein a surface of the wiring board is scanned with a scanning speed of 8 m/min and a scanning pitch of 100 μm while irradiating the machined portion with the laser beam for a beam irradiation time ranging from 10 to 200 μs and at intervals of a beam irradiation pausing time of 2.5 ms.

13. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board with a metallic layer formed on a base material surface, and the method comprising the steps of:

previously removing the metallic layer corresponding to a machined portion of the wiring board; and

flowing a gas in a direction from a laser beam scanning start point to a laser beam scanning end point in the machined portion at a time of machining by irradiating a base material of the machined portion with a laser beam while scanning by the laser beam through the metallic layer removed portion.

14. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board with a metallic layer formed on a base material surface, and the method comprising the steps of:

forming the metallic layer having a desired shape by partially removing the metallic layer by pulse irradiation

with a laser beam having sufficient intensity to melt and remove the metallic layer; and

additionally irradiating a machined portion of the wiring board through the metallic layer removed portion with the laser beam having insufficient intensity to melt the metallic layer and a beam irradiation time ranging from 10 to 200 μs, and including a plurality of pulses forming a train at intervals of a beam irradiation pausing time of 15 ms or more.

15. A laser beam machining method for a wiring board according to claim 14, wherein the machined portion is exposed by previously removing, through another machining method such as etching, the metallic layer positioned at a target position for laser beam irradiation and in the range smaller than an area to be machined.

16. A laser beam machining method for a wiring board according to claim 14, wherein surface roughening is previously made to a surface of the metallic layer on a surface of the wiring board before the laser beam irradiation.

17. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the step of:

at a time of pulse irradiation with the laser beam while sequentially positioning a spot of the laser beam at target positions on the wiring board in synchronization with a pulse frequency of the laser beam, providing a time interval of 15

ms or more between two optional successive pulsed laser beams for irradiation of the respective target positions irrespective of the pulse frequency by irradiating another target position with a pulsed laser beam outputted for the time interval therebetween.

18. A laser beam machining method for a wiring board, using a laser beam for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the method comprising the steps of:

providing a plurality of machining stations on which the wiring boards to be machined are mounted;

sequentially dividing a pulsed laser beam outputted from a laser oscillator among the plurality of machining stations for each pulse; and

introducing the pulsed laser beam into the plurality of machining stations at time intervals of 15 ms or more.

19. A laser beam machining apparatus for a wiring board, using a laser beam radiated from a laser oscillator for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the apparatus comprising:

optical means for changing a direction of the laser beam and moving the laser beam on the wiring board while sequentially positioning a spot of the laser beam at target positions on the wiring board, and

control means for synchronous control between a pulse oscillating operation of the laser oscillator and an operation of the optical means, and control of the optical

means such that a time interval can be set to 15 ms or more between two optional successive pulsed laser beams for irradiation of the target positions irrespective of a pulse frequency of the laser oscillator.

20. A laser beam machining apparatus for a wiring board, using a laser beam radiated from a laser oscillator for machining such as drilling for a through-hole and a blind via hole, grooving, and cutting for an outside shape of the wiring board, and the apparatus comprising:

a plurality of machining stations on which the wiring boards to be machined are respectively mounted;

optical means for sequentially dividing a pulsed laser beam outputted from the laser oscillator among the plurality of machining stations for each pulse, and introducing the pulsed laser beam into the plurality of machining stations for each pulse at time intervals of 15 ms or more; and

synchronization control means for synchronous control between a dividing operation of the optical means and a pulse oscillating operation of the laser oscillator.

21. A laser beam machining apparatus for a wiring board according to claim 20, wherein the optical means is provided with at least one rotary chopper rotated at a predetermined speed of rotation, having a plurality of reflection surfaces and a plurality of passing portions at positions equally dividing a periphery about an axis in a plane perpendicular to the rotation axis, and the synchronization control means being provided with a trigger generating apparatus to generate a trigger each time all the equally divided areas including the plurality of reflection surfaces and the

plurality of passing portions in the rotary chopper respectively move across an optical axis of the laser beam.

22. A carbonic acid gas laser oscillator for machining for a wiring board, comprising:

a discharge space formed by feeding pulsed discharge power into a high-speed gas flow serving as a laser medium; and

an aperture through which a laser beam is derived from the discharge space such that an optical axis of the laser beam can be perpendicular to the gas flow;

wherein a length of the discharge space in a gas flow direction is equal to or more than a width of the aperture, an optical axis passing through a center of the aperture being set to be positioned in the range that an entire area of the aperture does not extend off an area extending in the gas flow direction of the discharge space and on the farthest upstream side of the gas flow, and a rise time and a fall time being set to 50 μs or less in the discharge power fed to the discharge space.